United States Department of Agriculture
Agricultural Research Administration

R.A.S. 136 (C) Issued June 1951

RESEARCH ACHIEVEMENT SHEET

Prepared in the public interest as a brief report of noteworthy research

CHEMICAL TREATMENT GIVES COTTON HIGH RESISTANCE TO ROT AND HEAT

Cotton yarn and fabric that resists rot and mildew and is able to stand higher temperatures than ordinary cotton is being produced at the Southern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry. The new cotton material looks like the regular product but lasts much longer in certain uses. It is made by a process called "partial acetylation." By adapting this process on a pilot-plant scale to the acetylation of cotton fiber, yarn, and a variety of fabrics, the Laboratory's research marks an important step in efforts to improve and add to cotton's natural qualities.

Rigorous practical tests have shown that partially acetylated cotton sandbags far outlast those made from untreated cotton or from cotton given standard rotproofing treatments. Partial acetylation is also a promising treatment for fishing gear. Partially acetylated covers for laundry presses resist scorching and charring and are several times more durable than ordinary cotton covers. A number of textile mills are considering the manufacture of these and other partially acetylated cotton products.

The process for producing such products is well adapted for commercial use. It employs glacial acetic acid and acetic anhydride, with perchloric acid as a catalyst, to convert the cellulose in cotton yarn or fabric to a partial acetate. The cotton remains nontoxic and is not changed in appearance. Unlike some processes used to improve cotton's rot resistance, partial acetylation leaves no stickiness, odor, or color. It is believed to be the most effective method so far developed to protect cotton from rot-causing microorganisms and from damage by heat.

Partial acetylation is not basically new (it was reported in England about 1900), but little information on its usefulness was available before 1942, when the Southern Laboratory began investigating the process. In early tests, strips of the treated cloth were buried in moist soil near the Laboratory in New Orleans. They resisted rotting for 6 months to a year. Partially acetylated sandbags stacked on damp ground lasted two years. In the same test, sandbags of ordinary cotton treated with copper naphthenate, a standard rotproofing chemical, decayed in 2 to 5 months.

One manufacturer has used partial acetylation successfully in treating cotton bags to hold chemicals for home water-softening systems. Under some conditions, regular cotton bags last only a month or two in this equipment, but the treated bags are good for more than a year.

Partially acetylated cotton fishing gear is under test in river and ocean waters on the East Coast. Nets and twines treated in this way have proved definitely superior so far to standard cotton gear. They were still good after 6 to 8 months' service, and would have been usable in fishing gear, while untreated cotton disintegrated in less than a month, and tar-coated cotton lost half its strength in 4 months.

Service tests by commercial laundries have demonstrated that partially acetylated cotton covers and flannel for pads for hot-head presses last 4 to 6 times as long as those made of untreated cotton. Ordinary covers normally char and crumble after about a week of regular use, but the treated materials remain serviceable for 4 to 6 weeks.

The Southern Laboratory has worked out methods for processing rolls of cloth on the standard dye jigs used in cotton finishing plants. Yarns can be treated in packaged form, on tubes. Data for control of temperature, amount of chemicals used, length of treatment, and other conditions required for best results have been determined. Although the treatment is expected to increase processing costs, this is more than offset by the greatly improved service life of partially acetylated cotton products. -- J. D. Dean, *Head, Cotton Chemical Processing Division,* Southern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry.

For reference data, see other side

REFERENCE DATA

R.A.S. 136 (C)

Unit responsible for achievement: Cotton Chemical Processing Division, Southern Regional Research Laboratory, New Orleans, La., Bureau of Agricultural and Industrial Chemistry.

Persons who conducted work: B. J. Adams, J. D. Bowes, E. M. Buras, Jr., J. H. Carra, A. S. Cooper, Jr., L. L. Fontaine, C. F. Goldthwait, L. Hagan, J. F. Keating, J. McLaren, and S. T. Voorhies.

Date of first official announcement: Auguet 20, 1945, in USDA press release.

Selected publication: Acetylated Cotton Highly Resistant to Rotting, Textile World 96 (2): 115-117, 212, 216, February 1946.

Selected illustrations: SRRL Neg. 818 -- Partially acetylated sandbag after 2 years' service; Neg. 1242 -- Superiority of partially acetylated bag in water-softening service; Neg. 1488 -- Pilot-plant acetylation of cotton yarn; Neg. 1495 -- Acetylation of cotton cloth in dye jig; Negs. 1683, 1684, 1685 -- Comparison of acetylated and unacetylated laundry press covers.

Estimated cost of achievement: Approximately $95,000, based on salaries, supplies, and equipment.

Estimated value of achievement: Partial acetylation definitely increases the durability, and hence the usefulness, of cotton in various applications. Developments to date (see *Status and application)* indicate that the treatment will promote wider use of cotton and help the fiber to retain certain of its markets. Since the process has had only limited commercial use so far, it is impossible at present to assess its potential dollar value. However, in view of cotton's increasing competition from synthetic fibers, it is evident that improvement of the properties of cotton by partial acetylation is an achievement of advantage to the cotton industry.

Status and application: Partially acetylated cotton yarns and fabrics for various test purposes are being produced on a pilot-plant scale in the experimental textile mill at the Southern Laboratory. More than 400 requests for information on the industrial possibilities of the process have been received by the Laboratory. One firm has successfully used laundry machines to treat cotton osnaburg bags for holding the chemicals employed in home water-softening systems. Partially acetylated cotton has proved highly suitable for these bags, which are subjected in normal use to severe biological attack. Fishing nets and twines of partially acetylated cotton are still undergoing tests by the fishing industry, so far with excellent results. Partially acetylated cotton flannels and press covers being tested by commercial laundries have proved highly satisfactory to date. This type of cotton fabric is potentially useful also for plastic laminates and varnished electrical insulation fabrics. Although the process is economical and produces a striking improvement in cotton's resistance to rotting and heat damage, the fact that it does add to the cost of cotton goods and requires organic solvents rather than the water solutions preferred by textile plants has delayed its acceptance by industry. The Southern Laboratory is therefore continuing research on partial acetylation to develop a simplified, continuous process that may be cheaper and more attractive to manufacturers.

Subappropriation: Regional Research Laboratories.

Fiscal years in which work was done: 1942-1950.

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE

R.A.S. 189 Issued October 1957

RESEARCH ACHIEVEMENT SHEET

Prepared in the public interest as a brief report of noteworthy research

USDA DEVELOPS SIMPLE NEW THEORY OF FLAME RESISTANCE IN COTTON

Scientists at USDA's Southern Utilization Research and Development Division have succeeded in establishing a simple general theory applicable to methods for imparting flame-retardant properties to cotton and other cellulosic textiles. Application of this theory is aiding in the development of new and more efficient chemical agents to prevent cotton from burning.

Ever since man discovered and utilized fire he has been concerned with the combustibility of textiles and wood. For at least two hundred years efforts have been made to discover why cotton treated with certain chemical agents will char but not burn. However, none of the theories proposed proves applicable to all flame-retardant agencies that can be used on cellulose, the principal component of cotton and wood.

The wide use of incendiaries in modern warfare has made it necessary to develop an efficient method of making military textiles flame resistant. Also, the increasing number of deaths from bedding fires and fires caused by unprotected space heaters has made treatment of civilian clothing and bedding desirable.

Commencing in 1951, a program of research on the flame resistance of cotton textiles was undertaken by the Southern Utilization Research and Development Division supported in part by funds supplied by the Office of the Quartermaster General, Department of the Army, and conducted under the general supervision of the Quartermaster Research and Development Laboratories (now located at Natick, Massachusetts). Results of these studies indicated the following:

Samples of cotton treated with effective flame-resistant agents decompose at a lower temperature than untreated cotton to yield mostly water vapor and a carbonaceous, non-flammable char rather than the usual large quantities of flammable vapor. Although some flammable vapors are produced even with treated cotton, in many cases this source of flammability is reduced or eliminated by the presence of certain volatile compounds from the treating agent used.

From these data and suitable analyses of the residue, a working hypothesis was derived which may be stated as follows:

1. Flame retardancy in cellulosic materials is brought about by catalytic dehydration through the reaction of a flame-resistant agent with cellulose, generally via a carbonium-ion mechanism, which is probably identical to that proposed for the dehydration of monohydric alcohols and glycols.

2. The flame-retardant agent must be present, or must be produced from its precursor, at a temperature close to that of burning cellulose, but it must not be excessively volatile at 300 degrees to 500 degrees Centigrade.

3. The agent (or its precursor) must not burn readily by itself.

4. In general, an effective flame-retardant agent must be a Lewis acid or capable of forming a Lewis acid at the temperature of burning cellulose.

5. Subsidiary benefits are obtained by changes in the flammability of the evolved gases.--Carl M. Conrad, *Head, Cotton Fiber Section*, Southern Utilization Research and Development Division, Agricultural Research Service.

For reference data, see other side

REFERENCE DATA

R.A.S. 189 Issued October 1957

Unit Responsible for Achievement: Cotton Fiber Section, Southern Utilization Research and Development Division, Agricultural Research Service, New Orleans, La.

Persons Who Conducted Work: J. David Reid, Hartwig A. Schuyten, Jeremiah W. Weaver.

Date of First Official Announcement: March 1953. Meeting of the American Chemical Society, Los Angeles, California.

Selected Publications: Some Theoretical Aspects of the Flameproofing of Cellulose Advances in Chemistry, Series No. 9, pp. 7-20, June 1953. The Effect of Flameproofing Agents on Cotton Cellulose, Ind. Eng. Chem. *47*, pp. 1433-9 (1955).

Estimated Cost of Achievement: Approximately $65,000, based on salaries, supplies and equipment. The Office of the Quartermaster General contributed approximately $37,500 of this total amount.

Estimated Value of Achievement: No direct monetary value can be assigned. Results of this study have helped in the improvement of known flame-retardant agents for cotton, and in the development of effective new agents.

Status and Application of Achievement: The theory has been found to be generally applicable to flame-resistant agents for cellulosic textiles and has stimulated much interest in research in this field. The Office of the Quartermaster General has decided to extend the work along lines indicated by the theory.

Fiscal Years in Which Work Was Done: 1951-1954.

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE

R.A.S. 194

Issued January 1958

RESEARCH ACHIEVEMENT SHEET

Prepared in the public interest as a brief report of noteworthy research

ACCELERATED AERATION PROCESS TAKES CARE OF DAIRY WASTES

A simple and economical dairy-waste disposal process, developed by U. S. Department of Agriculture scientists, is helping to answer the Nation-wide problem of stream pollution by wastes from dairy plants.

Some milk waste—especially in the water used in washing equipment--is unavoidable in any milk plant. Disposal of this waste has long been one of the dairy industry's most serious problems.

Dairy wastes usually are discharged into streams, where the milk solids are converted into bacteria To develop and grow, aerobic bacteria must have plenty of oxygen. Thus, the stream's oxygen supply is soon reduced, aquatic life dies, and the water becomes polluted and gives off putrefactive odors. The result is destruction of fish and wildlife, and reduced property and recreational values.

Although the dairy industry worked on this problem for many years, no entirely satisfactory answer was found. Customary sewage treatment is too expensive and is often inadequate because the polluting strength of milk waste is 3 to 4 times greater than that of household waste.

The situation has become increasingly serious, and to protect health, property, and recreational values of streams, many States have passed and are strictly enforcing laws prohibiting such stream pollution.

Scientists at the Agricultural Research Service's Eastern Utilization Research and Development Division--with the cooperation of the Pennsylvania State University--tackled the problem and developed the new disposal system, which is being installed with remarkable success by an increasing number of commercial dairy plants.

In this method, waste from the dairy flows into a tank containing sludge--a bed of bacterial cells. The waste is then pumped out and returned to the tank through aspirators, which mix air with the waste and bubble it through the sludge to burn up the organic materials (mostly proteins and sugars). After aerating for 8 to 16 hours, depending on the amount of waste, the sludge is allowed to settle. The liquid in the upper part of the tank--now essentially free of polluting material--is drawn off and discharged into a stream or sewer. The settled sludge remains as a starter for the next day's waste.

The initial sludge is developed by aerating the milk waste with bacteria commonly found in soil, spoiled milk, or activated sludge. In a few days the bacterial population builds up to the desired level. It then becomes self-balancing--that is, growth and self-oxidation of the bacteria keep the sludge at this level as long as the flow of waste is uniform. Bacteria numbers may subsequently multiply or decrease, depending on the amount of waste to be handled.

Quick, economical treatment requires adequate oxygen as well as a high concentration of bacteria. The bacteria use 1.4 pounds of oxygen in consuming 1 pound of milk solids. Determining the oxygen demand (polluting strength) of the waste is the first step in setting up the system. This is done by a simple, rapid chemical test.

The new disposal system is trouble-free, automatic, and self-cleaning. It eliminates odors, requires no chemicals, and reduces labor needs by more than 90 percent. It requires only one tank, electrical power, aspirators, and a clock mechanism for automatic operation. It can be built for less than one-third of the cost of a small, conventional disposal system. Moreover, by doing away with stream pollution, it greatly benefits both the dairies and the public generally.--Thomas L. McMeekin, *Head, Animal Proteins Section,* Eastern Utilization Research and Development Division, Agricultural Research Service.

For reference data, see other side

REFERENCE DATA

R.A.S. 194 Issued January 1958

Unit responsible for achievement: Eastern Utilization Research and Development Division, Agricultural Research Service, in cooperation with the Pennsylvania State University.

Persons who conducted work: S. R. Hoover, N. Porges, L. Jasewicz, and J. Pepinsky.

Date of first official announcement: March 1952.

Selected publications: Treatment of dairy waste by aeration. II. Continuous aeration studies, 5th Indus. Waste Conf. Proc., p. 137, Purdue Engin. Ext. Serv. 72, 1950; Biochemical oxidation of dairy wastes. I. Methods of study, Sewage and Indus. Wastes *22*: 318, 1950; Aeration as a partial treatment for dairy wastes, 6th Indus. Waste Conf. Proc., p. 313, Purdue Engin. Ext. Serv. 76, Nov. 1951; Assimilation of dairy waste by activated sludge, Sewage and Indus. Wastes *23*: 167, 1951; Assimilation of dairy waste by activated sludge. II. The equation of synthesis and rate of oxygen utilization, Sewage and Indus. Wastes *24*: 306, 1952; Treatment of dairy waste by aeration, AIC-332, March 1952; Biochemical oxidation of dairy wastes. IV. Endogenous respiration and stability of aerated dairy waste sludge, Sewage and Indus. Wastes *24*: 1144, 1952; Biochemical oxidation of dairy wastes. V. A review, Sewage and Indus. Wastes *25*: 201, 1953; A microbiological process report, Aerobic treatment of dairy wastes, Applied Microbiol. *1*: 262, 1953; An interpretation of the B.O.D. test in terms of endogenous respiration of bacteria, Sewage and Indus. Wastes *25*: 1163, 1953; Borax as a preservative of dairy waste for the B.O.D. test, 8th Indus. Waste Conf. Proc., Purdue Engin. Ext. Serv. 83, p. 387, Jan. 1954.

Selected illustrations: Photographs of equipment used in recent installation units are available at the Eastern Utilization Research and Development Division, Philadelphia 18, Pa.

Estimated cost of achievement: $250,000, including salaries, equipment, and contracts.

Estimated value of achievement: A plant using the rapid aeration process costing about $15,000 can do the work of a conventional plant costing about $45,000. Since the waste disposal process is potentially applicable to at least 500 dairy plants in this country, it may be calculated that this achievement has a value of approximately $15,000,000.

Status and application of achievement: The rapid aeration process for dairy waste disposal has been successfully applied to about 60 full-scale commercial milk processing plants. A number of other commercial plants are in the process of building waste disposal units of this type. The ideas developed in this project have been incorporated in numerous waste disposal systems of various types.

Fiscal years in which work was done: 1948-55.

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE

R.A.S. 195 Issued January 1958

RESEARCH ACHIEVEMENT SHEET

Prepared in the public interest as a brief report of noteworthy research

ATTAPULGITE MAKES GOOD INSECTICIDE CARRIER

Insecticide manufacturers have confirmed researchers' selection of attapulgite, a light and fluffy fuller's earth, as among the best available dust carriers of agricultural insecticides. More than 60 percent of all commercial insecticide dusts now use attapulgite as a diluent and carrier.

Attapulgite (fuller's earth E90-44B) was originally selected by the Eastern Utilization Research and Development Division and the Entomology Research Division of the Agricultural Research Service as a carrier for nicotine sulfate. The selection was made after comparative tests of 37 dust carriers, including talcs, kaolin, clays, gypsum, walnut shell flour, magnesia, limestone, and pyrophyllite. The melonworm and the southern armyworm were used as test insects.

Although several of the materials met one or more requirements, the inexpensive and abundant attapulgite proved most satisfactory when all the requirements of a good carrier were considered. The results were only preliminary, since not more than one type of insecticide and two species of insects were considered. Nevertheless, the indications were encouraging enough to suggest that attapulgite be tried as an insecticide carrier. By April 1947, when the results of these preliminary trials were published, attapulgite had already found extensive commercial use.

It is fine enough to disperse well from dusting machines but not so fine that it drifts away from the treated area. The fine particles also prevent loss of toxicity of the insecticide by volatilization after application, thus giving greater and longer lasting control. In the tests, 98.8 percent of the nicotine remained after 16 hours exposure. The particles are soft enough to flow through the nozzles without wearing the metal excessively. (A flinty or crystalline dust will quickly wear nozzle openings, permitting the release of excessive amounts of insecticide and increasing the cost of maintaining the application equipment.)

Attapulgite does not react chemically with insecticides and does not interfere with their insect-killing power. It can absorb large quantities of toxic fluids and still remain an easy-to-apply dust. It can be spread satisfactorily by airplane and has contributed to the increasing use of this large-scale method of insecticide application.

Industry tests with toxicants other than nicotine sulfate have shown attapulgite to be highly satisfactory as a carrier for DDT and many of the newer chlorinated insecticides. It is now being used in the formulation of at least five insecticides by a number of manufacturers.--Dr. J. J. Willaman, *Head, Biochemical Section,* Eastern Utilization Research and Development Division, Agricultural Research Service.

For reference data, see other side

REFERENCE DATA

R.A.S. 195 (C) Issued January 1958

Unit responsible for achievement: Eastern Utilization Research and Development Division, and Entomology Research Division, Agricultural Research Service.

Persons who conducted work: C. F. Woodward, F. B. Talley, A. Eisner, J. J. Willaman, E. L. Mayer, and R. H. Nelson.

Date of first official announcement: April 1947 (See reference below).

Selected publications: Nicotine Insecticides. Part III, Dust Carriers for Nicotine. E-720, 1947 (processed).

Estimated cost of achievement: About $5,000, based on salaries.

Estimated value of achievement: The dollar value to insecticide manufacturers is unknown, but a rough estimate of the dollar value to users can be arrived at as follows: In 1956 almost $100 million worth of insecticides were used in agriculture. Assuming that only 1 percent of this amount represents the greater efficiency realized through insecticides using attapulgite, the gain to farmers is close to $1 million per year.

Status and application of achievement: Attapulgite is now the leading insecticide carrier, it can be used with most toxicants, including many of the newer ones.

Fiscal years in which work was done: 1944-45

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE

R.A.S. 196 Issued January 1958

RESEARCH ACHIEVEMENT SHEET

Prepared in the public interest as a brief report of noteworthy research

RESEARCH FINDS NEW OUTLETS FOR TALLOWS AND GREASES IN LIVESTOCK FEEDS

At least 300 million pounds of industrial grade tallows and greases--and potentially much more--are going into commercial animal feeds annually, as a result of research sponsored and supervised by the Agricultural Research Service's Eastern Utilization Research and Development Division. This research--conducted as part of the Department of Agriculture's search for new uses for surplus animal fats and oils--was carried out under contract by the American Meat Institute Foundation of the University of Chicago.

The Foundation scientists determined the nutritional advantages of additional fat in dog and poultry feeds and developed methods for stabilizing and incorporating the fats. Other laboratories extended the studies to beef cattle, hogs, turkeys, and sheep, all of which were found to benefit from feeds fortified with animal fats.

Animal fats are high energy foods, yielding 9 calories per gram when metabolized in the body, and contribute to more efficient use of other nutrients in the diet. During storage, they help preserve the nutritive value of mixed feeds by reducing oxidation of the carotene and vitamin A, as well as improving the appearance and palatability of the feed. They help make up for the reduced fat content of soybean and cottonseed meals resulting from efficient oil-extracting methods used today.

Adding fat to feeds also has another advantage: it eliminates dustiness in the feeds, thereby improving working conditions for workers in mills, stores, and barns, and reducing the hazard of dust fires and explosions. Moreover, it reduces loss of feed by holding the lighter feed particles together so they cannot blow away. It is estimated that dust control of all our dehydrated alfalfa meal would require 25 million pounds of fat annually; all mixed feeds would take about 700 million pounds. This estimate is based on feed containing only 1 percent fat. Research has shown that animals thrive on feed containing much higher levels of fat, and many commercial feeds contain as high as 8 percent.

This new market for inedible animal fats has meant better prices for livestock producers and meat packers. In less than 2 years the value of this byproduct rose from less than 5 cents to 7 to 9 cents per pound, or approximately to the point research has shown to be the minimum value for these fats in relation to other feed components. Thus, inedible animal fat is taking its place both nutritionally and pricewise in the commercial livestock feed industry.--W. C Ault, *Head, Animal Fats Section,* Eastern Utilization Research and Development Division, Agricultural Research Service.

For reference data, see other side

REFERENCE DATA

R.A.S. 196 Issued January 1958

Unit responsible for achievement: Animal Fats Section, Eastern Utilization Research and Development Division, Agricultural Research Service, Philadelphia 18, Pa.

Persons who conducted work: Personnel of the American Meat Institute Foundation under contract supervised by Roy W. Riemenschneider, Eastern Utilization Research and Development Division.

Date of first official announcement: October 1952 (see first reference below).

Selected publications: Effect of the Level of Fat in the Diet on the Growth Performance of Dogs, Jour. Nutr. *48*: 81, 1952; Effect of Feeding Graded Levels of Fat with and without Choline and Antibiotic + B_{12} Supplements to Chicks, Poultry Sci. *32*: 449, 1953; Animal Fats in Livestock Feeds, Chemurg. Digest, p.4, Dec. 1954; Use of Inedible Fats in Dry Dog Foods and Poultry Rations, Amer. Meat Inst. Found. Bul. 15.

Estimated cost of achievement: Approximately $40,000, representing salaries and expenses.

Estimated value of achievement: Development of this new market has played a significant part in elevating the price level of inedible animal fats from less than 5 cents a pound to 7 to 9 cents a pound. This has resulted in an increased return to the livestock industry of approximately 70 million dollars. In addition, livestock and poultry growers can produce their animals more efficiently and cheaply; a large cooperative estimates poultry feeders are saving about 80 cents per ton of feed.

Status and application of achievement: The achievement has been of almost immediate help to livestock producers, renderers, and feed manufacturers. During the 2 years immediately following the publication of the results of the investigation, the use of tallows and greases in feeds increased rapidly; current annual use is more than 300 million pounds.

Fiscal years in which work was done: 1951-53

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE

A.S. 200 Issued November 1958

RESEARCH ACHIEVEMENT SHEET

Prepared in the public interest as a brief report of noteworthy research

HIGH-SHEAR REFINING IMPROVES QUALITY AND YIELD OF COTTONSEED OIL

A new method for refining crude cottonseed oil, developed at the ARS Southern Utilization Research and Development Division, is saving oil producers at least $1 million annually. Called high-shear refining, it employs very rapid agitation of the oil. This method is an improvement over conventional alkali refining, because it provides more thorough contact of alkali with the impurities in crude oil, permitting a more complete conversion of the color bodies in the oil to removable substances. The method also reduces undesirable side reactions encountered in conventional refining and results in higher yields and better quality oil. In addition, high-shear refining often eliminates the need for re-refining off-color oils.

Cottonseed-oil refining consists essentially of treating the crude oil with a water solution of an alkali. After slight agitation, the oil and alkali solution easily blend to form a milky emulsion. Heat is applied to break the emulsion into a mixture of large flakes of soft soap and oil. The mixture is then separated into a clear, refined oil and a semi-solid soapstock.

It had previously been assumed that a minimum of agitation should be used in the oil-alkali blending step of the refining process. Once the emulsion had formed, the soapstock and other surface-active agents were thought to maintain it in as fine a state of dispersion as was desired. In fact, when refining crude cottonseed oil by conventional practices, care is taken to avoid undue agitation. Prolonged and vigorous agitation was believed to defeat the primary object of refining—the removal of non-glyceride components with the least possible loss of glyceride components. The glycerides, which compose the bulk of the processed edible oil, are capable of reacting with alkali. It was therefore assumed that prolonged agitation would lead to excessive reaction between the glycerides and the alkali, resulting in costly oil losses.

Scientists of the Southern Division discovered, however, that high-shear agitation actually aids refining. It causes closer contact between alkali and oil by tearing apart droplets of concentrated lye in the emulsion. Thus, the lye can react with the color bodies before it becomes diluted by reaction and solution with other non-glycerides. Study of high-shear processing showed that mixing time, temperature, type of alkali, its concentration, and the amount used in proportion to the crude oil are also important in the process. Use of optimum processing conditions as determined in this research results in higher yields of lighter colored, and therefore better quality, refined cottonseed oil.—T. H. Hopper, *Chief, Industrial Crops Laboratory*, Southern Utilization Research and Development Division, Agricultural Research Service.

For reference data, see other side

REFERENCE DATA

R.A.S. 200 Issued October 1958

Unit responsible for achievement: Industrial Crops Laboratory, Southern Utilization Research and Development Division, New Orleans.

Persons who conducted work: R. O. Feuge, K. S. Markley, E. J. Vicknair, N. V. Lovegren, and J. G. Kroonen (Research Fellow, The Coolidge Foundation).

Date of first official announcement: May 1, 1951.

Selected publications: Refining Cottonseed Oil at High Rates of Shear, J. Am. Oil Chemists Soc. *33* (8): 344-47 (1956); Re-refining Cottonseed Oil at High Rates of Shear, J. Am. Oil Chemists Soc. *29* (2): 65-71 (1952). U. S. Pat. No. 2,686,796, Process for Alkali-Refining Crude Natural Oils, August 17, 1954.

Estimated cost of achievement: $25,000 including equipment and supplies.

Estimated value of achievement: It is estimated that the cottonseed-oil industry has benefited by at least $1,000,000 annually since 1952 from the development of high-shear refining. Value of the method is greater in some years than in others, depending on the quality of the cottonseed produced. Bad weather during the growing season may result in seed that yields off-color oils, which require additional processing. High-shear refining reduces the amount of such processing needed. When used on oil from cottonseed produced during a normal growing season, high-shear refining generally yields a prime colored product at the outset, with minimum need of re-refining.

Status and application of achievement: Cottonseed-oil processors have widely adopted high-shear alkali refining and the supplemental procedures developed by the Southern Division. Most of the equipment employed commercially for this process has been fabricated by the plants that use it. However, one equipment manufacturer has designed a high-shear refining apparatus for the firm's standard line of products.

Fiscal years in which work was done: 1951-52

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE

R.A.S. 202 Issued October 1959

RESEARCH ACHIEVEMENT SHEET

Prepared in the public interest as a brief report of noteworthy research

THE SRRL COTTON OPENER-CLEANER, A MODERN, EFFICIENT MACHINE FOR CLEANING COTTON

A new opener-cleaner for cotton mills that combines outstanding cleaning efficiency with superior opening and blending capacity has been developed by engineers of the U. S. Department of Agriculture's Southern Utilization Research and Development Division at New Orleans.

The new opener-cleaner, which has demonstrated savings up to $100 a day per machine and has resulted, in some cases, in a full grade increase in fabric quality, has already gained wide commercial acceptance in the cotton milling industry.

The opener-cleaner represents a major contribution in a broad USDA research effort toward developing a complete system for cleaning cotton. The machine may also prove to be an important factor in the South's transition to mechanized cotton harvesting. The opener-cleaner has proved highly efficient in removing trash -- the stem and leaves -- that are characteristic of mechanically-harvested or rough hand-harvested cotton, cutting nearly in half the loss of spinnable fiber.

The opener-cleaner is basically the SRRL Cotton Opener, developed earlier at the Southern Laboratory by engineers of USDA's Agricultural Research Service. The new apparatus has a built-in cleaning device, however, and a production capacity up to 1,600 pounds of cotton per hour. It requires less air to operate, and is only slightly larger. The opener-cleaner's performance is indicated by the fact that its average cleaning efficiency is 30 percent at 1,500 pounds per hour and that the waste it removes contains about 85 percent trash and only 15 percent lint and short fibers.

The opener-cleaner has four opening-blending cylinders and two cleaning cylinders. Each cleaning cylinder is equipped with two combing rolls and a series of conventional grid-bars applied in an unconventional manner. Doffing the cotton is accomplished by revolving strip-type brushes, which cannot damage the cotton or the teeth of the cleaning cylinders. The machine is commercially available in sizes to process up to 1,500 pounds of cotton per hour. The 1,500-pound-capacity model is the same height and width as a standard 34-inch-model SRRL Opener and is only 18 inches longer. -- E. L. Patton, *Chief, Engineering and Development Laboratory*, Southern Utilization Research and Development Division, Agricultural Research Service.

For reference data, see other side

REFERENCE DATA

R.A.S. 202 Issued October 1959

Unit responsible for achievement: Machinery Development Investigations, Engineering and Development Laboratory, Southern Utilization Research and Development Division, Agricultural Research Service, New Orleans, La.

Persons who conducted work: R. A. Rusca, R. C. Young, E. F. Wallace, and W. A. Latour.

Date of first official announcement: October 2, 1957 (in USDA press release 2972-57).

Selected publications: The SRRL Integrated System of Opening and Cleaning Cotton - The Opener-Cleaner, Textile Research J. *27* (7): 558-564 (1957); Machine Removes One-Third of the Trash, Textile Inds. *122* (4): 145-146 (1958); Cotton Opener, U.S. Patent No. 2,780,839, February 12, 1957, R. C. Young and R. A. Rusca.

Selected illustrations: Experimental Opener-Cleaner, SURDD Neg. No. G8-21dl-3.

Estimated cost of achievement: Approximately $230,000 based on salaries, supplies, and equipment.

Estimated value of achievement: The SRRL Opener-Cleaner shows a greater potential savings than its predecessor, the SRRL Cotton Opener. It is estimated that this new machine will save from $1 to $2 per bale due to its excellent trash removal capacity and ability to reduce spinnable-fiber losses. Also important is the fact that the opener-cleaner facilitates processing mechanically harvested cottons in textile mills with the same degree of efficiency with which equal grades of hand-picked cotton are handled. As a result, the opener-cleaner has a direct bearing on the economic position of the cotton farmer as well as the textile industry.

Status and application of the achievement: Four manufacturers of textile equipment are in commercial production of the opener-cleaner under license from the U. S. Department of Agriculture. The machine is available in sizes to process from 500 to 1,500 pounds per hour. By August 1959, the textile industry had installed 35 machines and others were on order. One large mill group, after extensive evaluations, plans to install 10 additional opener-cleaners.

Fiscal years in which work was done: 1952-1957